

REMARKS

Claims 1, 5-36 and 38-59 are pending. New claims 60-74 are added by this amendment. Support for these new claims is found in the specification. Claims 2-4 have been canceled without prejudice. Claim 37 has been withdrawn from consideration. Claims 1-36 and 38-59 were rejected over prior art as discussed below.

REJECTIONS

Mehalla (US 4,465,811)

Claims 1, 2, 4-8, 12, 13, 15, 16, 18-20, 22, 23, 25-36, 38-45, 47-52 and 54-59 were rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious in view of U.S. Patent No. 4,465,811, issued to Mehalla, ("Mehalla").

Amended claim 1 defines component (a) as a free-radically polymerized oligomer polymerized from at least one monomer selected from the group consisting of vinyl aromatic monomers and -ester functional monomers and at least one monomer selected from the group consisting of epoxy functional monomers, anhydride functional monomers, ester functional monomers and carboxylic acid functional monomers. Accordingly, the oligomer requires a functional monomer.

Mehalla discloses "an aromatic hydrocarbon resin containing, in particular, units derived from indenenes and styrenes, said resin having vinylketone groups grafted onto the aromatic nuclei thereof, said vinylketone groups having the general formula $RR'C=CR''-CO-$, in which the radicals R, R' and R'', being identical or different, represent hydrogen, methyl, ethyl, n-propyl, isopropyl, or halogen". Mehalla further discloses that "The aromatic hydrocarbon resin intermediate according to the invention is obtained by treating with an unsaturated acid chloride, an aromatic hydrocarbon resin used as the starting material and obtained, for example, by the polymerization of mixtures of aromatic hydrocarbons advantageously originating from the steam cracking of naphtha". Also, "mixtures (of aromatic hydrocarbons) are polymerized, preferably by conventional cationic polymerization, e.g., in the presence of a Lewis acid". (Col. 1, ln 40 - col. 2, ln 21)

Mehalla does not anticipate or render obvious the invention defined in the instant claims as it does not teach all elements defined in the amended claims. Mehalla does not anticipate the instant claims as it does not define a free-radically polymerized oligomer, nor does it define the functional monomers, such as vinyl aromatic monomers or ester functional monomers or epoxy functional monomers, anhydride functional monomers, ester functional monomers or carboxylic acid functional monomers used to obtain the oligomer of the present invention.

The claims are not obvious in view of Mehalla because Mehalla does not suggest the invention of the instant claims. Mehalla discloses that the aromatic hydrocarbon resins are made by grafting of aromatic hydrocarbon resins, followed by polymerization of mixtures of aromatic hydrocarbons, preferably by cationic polymerization. In contrast, to the cationic polymerization of Mehalla, the polymer of the instantly claimed invention, is obtained by anionic polymerization. Mehalla does not suggest the functional monomers of the present invention. The aromatic hydrocarbon disclosed in Mehalla contains vinylketone groups and this teaching does not suggest the epoxy, anhydride, ester or carboxylic acid functional groups on monomers as defined in the present invention. In example 7 of Mehalla, polymethyl methacrylate is taught. Even if this were considered the "oligomer" as defined in the instant claims, reaction of it with the aromatic hydrocarbon resin would not render the instantly claimed invention obvious, for the reason that the resin defined in Mehalla is obtained by cationic polymerization and the instant claims define that oligomer is reacted with a polymer obtained by anionic polymerization.

Mehalla does not render the present invention obvious as it teaches away from the present invention. Mehalla is directed to much higher molecular weight polymers than those taught by the present invention. Mehalla discloses that "[t]he resultant vinyl ketone containing aromatic hydrocarbon resin intermediates can [] be converted to very high molecular weight polymers, e.g. weight average molecular weight of 10^4 to 2×10^7 " (Col 2, ln 60 - 63). The instant claims in claims 8 and independent claim and define polymers having a number average molecular weight of from 20,000 to 300,000 g/mol and 3000 to 300,000 g/mol, respectively.

In view of the differences defined in the instant claims from the invention defined in Mahalla, Applicants submit that the claims are not anticipated or obvious over the reference and respectfully request withdrawal of the rejections

Handlin, Jr. et al. (EP 0634420)

Claims 1, 2, 4-13, 15, 16, 18-20, 25-36, 38-45, 47-52 and 54-59 were rejected under 35 U S C 102(b) as anticipated by European Patent Application Publication No 0 634 420, filed by Handlin, Jr. et al ("Handlin"). The Examiner states that Handlin's Example 4 discloses a reaction product of an anionically produced polyisoprene "of 6850 molecular weight

Handlin summarize their invention, stating the "invention relates to a star polymer made by anionically polymerizing a conjugated diene to form living polymer arms and coupling the arms with a coupling agent for star polymers." Pg 2, ln 42-44. "[T]he star polymers are made by coupling polymer arms using a polyfunctional coupling agent or coupling monomer. A preferred coupling agent is a polyalkenyl aromatic coupling agent" Examples of such coupling agents include polyvinyl aromatic compounds such as 1,2-divinylbenzene; 1,3-divinylbenzene; 2,2'-divinyl-4-ethyl-4'-propylbiphenyl and the like disclosed in US 5,104,921 (col. 12, ln 51 - col 13, ln 33). In order to anticipate the instant claims the reference must teach all of the elements of the claims. Handlin does not teach oligomer (a) as defined in the instant claims. The block polymer arms formed by polymerizing conjugated diene in Handlin do not correspond to the oligomer (a) component made from reaction of functional monomers selected from vinyl aromatic monomers or ester functional monomers and reacted with compounds selected from epoxy functional monomers, anhydride functional monomers, ester functional monomers or carboxylic acid functional monomers as defined in amended claim 1. For this reason the reference does not anticipate the instant claims.

The instant claims are not obvious in view of Handlin for the reason that the coupling agents taught by Handlin are prepared by polymerizing conjugated diene do not teach or suggest the free-radically polymerized oligomer as defined in the instant claims. The epoxidized polyisoprene of Example 4 is not the reaction product of a compound selected from the group consisting of vinyl aromatic monomers and ester functional

monomers and at least one monomer selected from the group consisting of epoxy functional monomers, anhydride functional monomers, ester functional monomers and carboxylic acid functional monomers. Therefore, the epoxidized polyisoprene in Example 4 of Handlin does not correspond to applicants' component "a". Other examples of the star polymer do not define reaction of the monomers set forth in the instant claims.

The claims are not obvious over Handlin for the further reason that the reference does not teach or suggest the molecular weight or polydispersity of the coupling agents defined in amended claim 1. Currently amended claim 1, defines that oligomers have "a number average molecular weight of about 1000 to about 10,000 g/mol and a weight average molecular weight of about 1500 to about 18,000 g/mol; a number average number of functional groups from about 4 to about 12; and a polydispersity index of about 1.5 to about 4.5". The coupling agents taught by Handlin do not have these characteristics. Accordingly, the oligomers as defined in claim 1 are not anticipated or obvious in view of Handlin.

Withdrawal of the anticipation and obviousness rejections over Handlin is respectfully requested.

Taubitz (EP 0201787)

Claims 1-36 and 38-59 were rejected under 35 U.S.C. 102(b) as anticipated by European Patent Application Publication No. 0 201 787, filed by Taubitz, et al. ("Taubitz"). The examiner noted that Applicants' international search report found that the Taubitz application anticipated Applicants' pending claims. The Taubitz application is written in German, and Applicants had it translated into English. A copy of the translated version is submitted herewith in a supplemental information disclosure statement.

Taubitz copolymerizes units I, II and III. Optionally, a unit IV can be copolymerized with units I, II and III. Unit I is a vinyl aromatic monomer, preferably styrene, alpha-methyl styrene and/or vinyl toluene. Unit II is a polymerized monomer containing nitrile groups, preferably acrylonitrile or methacrylonitrile. Unit III comprises a vinyl aromatic compound having a polymer attached to the aromatic ring, where the vinyl group remains available for copolymerization with units I and II. The polymer in unit III is formed through anionic polymerization.

With reference to the English translation of Taubitz, particularly the portion that corresponds to column 8, lines 1-8 of the German version, "[t]he structural unit III derives from a conversion product of chlormethyl styrene in particular, especially preferred from the conversion product of a mixture of m-chloromethyl styrene and p-chloromethyl styrene and a polymer Z obtained through anionic polymerization" The English translation of Taubitz further states on the same page that "[t]he polymers obtained, which form the main chain and which contain a chloromethyl or bromomethyl group bonded to a phenyl core, are converted using the polymer Z obtained through anionic polymerization The polymer, obtained through anionic polymerization, with the 'living' anion at the end of the chain is preferably converted at low temperature using the halogen methyl group of structural unit III in the polymer described above"

Taubitz teaches a substitution reaction for attaching an anionically polymerized polymer Z as a side chain to a main polymer backbone, where the polymer Z replaces a halogen such as chlorine or bromine The present invention is different Applicants' amended claim 1 is directed to the reaction product of an anionically polymerized polymer with a free-radically polymerized oligomer having at least one functional group obtained from "epoxy functional monomers, anhydride functional monomers, ester functional monomers and carboxylic acid functional monomers" The present invention does not use halogen substitution for bonding an anionically polymerized polymer to an oligomer, as taught by Taubitz

At the end of paragraph 60 of the present application, Applicants state "[t]he functional groups on the oligomers readily react with the carbanions on the anionically polymerized polymers to produce the modified polymers" Unlike the teaching in Taubitz, the present invention thus bonds an anionically polymerized polymer to an oligomer through a reaction between the living end of the anionically polymerized polymer and an epoxy, anhydride, ester or carboxylic acid functional group on the oligomer Consequently, Taubitz does not anticipate Applicants' amended claim 1 because Taubitz discloses substitution of a halogen group while amended claim 1 is directed to a reaction product between an anionically polymerized polymer and an oligomer that has epoxy, anhydride, ester or carboxylic acid functional groups

Taubitz also discloses an optional unit IV, which contains an ester group. Unit IV is preferably made using methyl methacrylate. Col. 7, second paragraph. Unit IV, if used, is bonded to units I, II and III in a manner so as to leave the ester functional group intact because Taubitz states "[t]he copolymer according to the invention is produced preferably by copolymerizing monomers so that they contain the structural units I, II and III (if necessary IV)." Col. 7, last paragraph. Structural unit III has the anionically polymerized polymer bound to it. The structure of each of units I, II, III and IV should be found in the copolymer. If unit IV is used, the ester group of unit IV should remain intact as a pendant group on the copolymer. Taubitz does not teach or suggest bonding an anionically polymerized polymer to the ester group of unit IV. Taubitz only teaches and suggests bonding the anionically polymerized polymer to unit III through substitution of the halogen group. Thus, although a copolymer having an ester functional group is disclosed, Taubitz does not anticipate or render obvious amended claim 1 of the present invention because there is no teaching or suggestion to bond an anionically polymerized polymer to an oligomer by reaction with an epoxy, anhydride, ester or carboxylic acid functional group on the oligomer since Taubitz instead bonds through halogen substitution on unit III, which does not have the claimed functionality.

Withdrawal of the anticipation and obviousness rejections over Taubitz is respectfully requested.

Powers et al. (US 5,548,023)

Claims 1-36, 38, 39, 45-48 and 50-59 were rejected under 35 U.S.C. 103(a) as obvious in view of U.S. Patent No. 5,548,023, issued to Powers et al. ("Powers").

The examiner has the burden to establish a *prima facie* case of unpatentability of the pending claims on any grounds, including anticipation and obviousness. MPEP 2142; *In re Oetiker*, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more, the applicant is entitled to grant of the patent. *In re Oetiker*, 24 U.S.P.Q.2d 1443; MPEP 2142. In order to establish that the claims are *prima facie* obvious over the prior art, the examiner must point to two things in the prior art, and not in the applicant's disclosure -- (1) the suggestion of the invention, and (2) the expectation of its success. *In re Vaeck*, 20

U S P Q 2d 1438, 1442 (Fed Cir 1991) See also MPEP 2143 The examiner has not met this burden

Powers uses substitution of a halogen group to bond an anionically polymerized polymer to a copolymer, which is the same mechanism that Taubitz employed. Amended claim 1 to the present invention does not use halogen substitution and is not anticipated or rendered obvious by Powers The examiner has not pointed to a suggestion in Powers of Applicants' amended claim 1, and without a suggestion, there can be no expectation of success Without a suggestion in Powers of the present invention or an expectation of success, the examiner has not met his burden of establishing a *prima facie* case of unpatentability in view of Powers

Powers "found that the preparation of an electrophile which comprises a copolymer of isoolefins having from 4 to 7 carbon atoms with halogenated para-alkystyrene is extremely important in obtaining the graft copolymers of the [Powers] invention which are useful both as polymers themselves and as such compatibilizers". Col. 10, lns 33-38 Powers discloses graft copolymer having "a monofunctional polymeric nucleophile having a molecular weight of at least about 1,000 and being sufficiently nucleophilic such that said nucleophile is capable of donating electrons to benzyl halides, thereby displacing the halogen from the benzyl halide." Col. 10, ln 65 - col 11, ln 3. The examiner cites this same nucleophile, referred to in Powers as "Nu" Beginning at column 12, line 65, Powers states "Nu comprises a nucleophilic residue provided by a polymeric nucleophile having a molecular weight of at least about 1,000 and being sufficiently nucleophilic such that said nucleophile is capable of donating electrons to benzyl halides, thereby displacing the halogen from the benzyl halide."

As discussed with reference to Taubitz above, Powers substitutes a nucleophile on a side chain by replacing a halogen, unlike the present invention With reference to the abstract and claims 1-3 in Powers, Powers claims a graft copolymer of isoolefin and para-alkylstyrene, where the para-alkyl group of at least one monomer contains a halogen and the para-alkyl group of another monomer contains "Nu," which "comprises a nucleophilic residue provided by a thermoplastic polymeric nucleophile having a molecular weight of at least about 1,000 and being sufficiently nucleophilic such that said nucleophile is capable of donating electrons to benzyl halides" Powers, claim 1 Claim

2 states that Nu is "yP, wherein y comprises a linked nucleophilic residue and P comprises a thermoplastic polymer. Claim 3 provides that the thermoplastic polymer can be polymerized by anionically polymerizable monomers."

Applicants' amended claim 1 comprises the reaction product of (a) a free-radically polymerized oligomer from at least one monomer selected from the group consisting of vinyl aromatic monomers and ester functional monomers, and at least one monomer selected from the group consisting of epoxy functional monomers, anhydride functional monomers, ester functional monomers and carboxylic acid functional monomers, and (b) an anionically polymerized polymer. The modified polymer of the present invention contains epoxy, anhydride, ester or carboxylic acid functionality. The present invention does not provide and does not rely on halogen substitution in reacting its anionically polymerized polymer with its functionalized oligomer. Consequently, Applicants' amended claim 1 is not anticipated nor is it rendered obvious by Powers because Powers does not teach or suggest reacting a vinyl aromatic monomer or an ester functional monomer with a monomer having epoxy, anhydride, ester or carboxylic acid functionality since Powers instead teaches substituting a halogen group. There is no suggestion in Powers that epoxy, anhydride, ester or carboxylic acid functionality can be used instead of a halogen, so Applicants' amended claim 1 is not obvious in view of Powers. Withdrawal of the anticipation and obviousness rejections over Powers is respectfully requested.

Mehalla in View of Powers

Claims 1, 2, 4-8, 12, 13, 15, 16, 18-20, 22, 23-36, 38-45, 47-52 and 54-59 were rejected under 35 U.S.C. 103(a) as being unpatentable over Mehalla, discussed above, in view of Powers, discussed above. The examiner states that Mehalla does not disclose the use of continuous polymerization, but says the use of continuous polymerization in Powers renders obvious the use of continuous polymerization in Mehalla. Applicants contend that amended claim 1 is patentable, as shown in the arguments above, and since continuous polymerization is in a claim that depends from amended claim 1, Applicants believe the claim concerning continuous polymerization is necessarily patentable. Applicants respectfully request that the obviousness rejection be withdrawn.

New Claims

Applicants submit that independent claims 23 defines a method for preparing an oligomer-modified anionically polymerized polymer and the polymer is as defined in claim 1. Independent claim 60 defines the oligomer-modified polymer as claimed in amended claim 1, with additional definition of the polymerization process. Applicants submit that the polymer as defined in claim 60 is not taught, suggested or defined by the cited prior art. Independent claim 61 defines a reinforced material that is asphalt, plastic or rubber and the polymer as defined in claim 1. Such reinforced materials are not taught suggested or defined in the prior art. Independent claim 64 defines asphalt combined with the polymer as defined in claim 1. Such asphalt material is not taught, suggested or defined in the cited prior art references. Independent claims 66 and 67 teach adhesives and plastics respectively, containing the polymer as defined in claim 1. The prior art does not teach, suggest or define such plastics or adhesives. Applicants submit that the independent claims are patentable over the art of record.

Conclusion

Accordingly, in view of the foregoing amendments and remarks, and in the absence of more pertinent art, Applicants respectfully request withdrawal of the rejections and reconsideration and allowance of all of the pending claims.

Respectfully submitted,



Anne Sabourin
Reg No 33,772

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BASF Corporation
1609 Biddle Ave
Wyandotte, MI 48192
Phone: (734)324-6197